MEMORIAL VERSES
ON THE
Ecclesiastical and Civil CALENDER:
WITH AN
EPITOME
OF THE
Heavenly Motions.

By THOMAS STREETE Student in *Astronomy* and *Mathematicks*.

Imprimatur,

Ex Ædibus Lamb.
Jul. 16. 1666.

Tho. Cooke, *Reverendissimo in Christo Patri & D.* Gilberto *Archiepiscopo* Cant. *Sacellanus Domesticus.*

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Burleſque is ſtale and Traveſty,
And all that Drolling Poetry
For Numbers now in Numbers flow,
And Time and Tide together go.
Here little Boyes that love to Play
May know when 'twill be Holyday,
And Men that are not Roſie-Crucians
May learn the Planets Revolutions.
In ſober ſadneſs, What d' you lack?
Here's your Perpetual-Almanack!

I. P.

Memorial Verſes.

To know if it be Leap-Year.

Divide the Year by 4; What's left ſhall be
For Leap-Year 0, for paſt 1, 2, or 3.

HEre you may omit the Hundreds and alſo the Twenties of the Year of our Lord; and onely divide the reſidue by 4.

For Example,

Anno 1667. omitting the Hundreds and alſo the 3 Scores, I divide the Reſidue which is 7, by 4; and there remaineth 3, which ſhews it is the Third after Leap-Year.

To find the Dominical-Letter.

Divide the Year, its 4th, and 4, by 7;
What's left ſubſtract from 7; the Letter's given.
A 1. B 2. C 3. D 4. E 5. F 6. G 7.

Example.

Of the Year of Chriſt	1667
The 4th part (omitting fraction) is	416
To both which I add the number	4
The Sum is	2087

which divided by 7, there is left 1, which ſubſtracted from 7, the laſt remainer

remainer 6 shews that the Dominical-Letter for the Year 1667 is the 6th in order of the Alphabet, that is F.

But the Leap-Year hath two Dominical-Letters; The Latter found by this Rule, serveth from St. *Matthias* Day to the Years End, and for finding *Easter*: The Former next following in order from A to G, and beginning again at A, serveth from the *New-Year* unto St. *Matthias*

For the Golden-Number, Cycle of the Sun, and Indiction.

When 1, 9, 3, *to th' Year hath added been,*
Divide by 19, 28, 15.

Example.

To 1667, I Add 1, the sum 1668 I divide by 19, and there remaineth 15, which is the *Golden Number* for the Year 1667.

Again, to 1667, I Add 9, and the sum 1676 I divide by 28, the residue 24 is the *Cycle of the Sun* Anno 1667.

Lastly, to 1667, I Add 3, the sum 1670 divided by 15, the remainer 5 is the *Indiction* for 1667.

The Prime or Golden-Number being given; To find the Epact.

Divide by 3; *for each one left add* 10;
30 *reject*: *the Prime makes Epact then.*

Example.

Anno 1667, The Golden-Number 15 I divide by 3, and there is left 0; therefore 10 times 0, which is 0, Added to 15, the sum is 15, the *Epact* Anno 1667.

By

By the 19 Epacts, To find the Day of Easter-Limit from the beginning of *March* inclusively.

The Epacts take from 47 ; but two
The greatest take from 77 : 'twill do.

Example.

Anno 1667. The Epact being 15, I substract it from 47, and the residue 32 is *Easter-Limit*, Anno 1667. that is *April* 1. reckoned from the beginning of *March* inclusively.

But when the Epact is 28 or 29, it must be substracted from 77, that so the Limit may remain. And the next following Sunday after the Limit is alwayes Easter-Day.

Easter-Limit, and the Dominical-Letter being given; To find Easter-Day.

The Letter more by 4 from Limit take ;
What's left from nearest Sevens shall Easter make.

Or thus,

Take the Number of the given Letter more by 4 from the given Limit, and the residue from the nearest greater sum of Sevens : the last remainer added to the Limit ; the Sum or its excess above 31, is Easter-Day in *March* or *April*.

Example.

Anno 1667. The Letter 6 more by 4, is 10, which taken from the Limit 32, the residue is 22, this taken from the nearest greater Sum of Sevens 28, there remaineth 6, which added to the Limit 32, the Sum is 38, the excess of which above 31, is 7. Therefore the 7th of *April*, *Anno* 1667, is Easter-Day.

For

For the Dayes of the Months on which ☉ entereth the 12 Signs.

Twice 9, *twice* 10, 4 *Twelves*, 11,
Then 10, *then* 9, *then* 8 *or* 7.
Anno 1700. ☉ in

♈.	♉.	♊.	♋.	♌.	♍.	♎.	♏.	♐.	♑.	♒.	♓.
Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
9.	9.	10.	10.	12.	12.	12.	12.	11.	10.	9.	8.

For the Degree of the Suns Place on any day.

From the Day of the Month on which the Suns Place is required, if you may, or else from the sum of that and 30, Substract the day of his entrance into the Sign of that Month; the remainer shall be the Degree of his Place in that or the next preceding Sign.

For the Age of the Moon, or the Day of her Change.

Janus 0, 2, 1, 2, 3, 4, 5, 6,
8, 8, 10, 10, *these to the Epact fix:*
The sum (*bate* 30) *to the Month-Day add;*
Or take from 30: *Age*; *or Change is had.*
Or thus,
Add to the Epact, in

Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
0.	2.	1.	2.	3.	4.	5.	6.	8.	8.	10.	10.

The Sum, if it be less then 30; or else, the Excess above 30; Added to the day of the given Month (rejecting 30 if need be) gives the Age of the Moon that day; but Substracted from 30, leaves the day of the Change in (or from the beginning of) that Month.

For the Day of the Full-Moon; Add or Substract 15, to or from the day of the Change.

Example.

(1) For the *Age* of the *Moon*, *Anno* 1667. *May* 29th. The Number for the Month 3, added to the Epact 15, makes 18, which added to 29 (rejecting 30 from the sum) gives 17, the *Age* of the *Moon* required.

(2) For

(2) For the day of the *Change* (or *New-Moon*) in *May* 1667. The Epact 15 with the Month 3, makes 18 (as afore) which substracted from 30, the residue 12 is the day of the *New-Moon* in *May*, 1667.

(3) The sum of 12 and 15, is 27, the day of the *Full-Moon* in *May*, 1667.

To find the Day of the New-Moon, and the Entrance of the Sun into the Signes, for Time Past or to Come.

312, 131,
Past Add, to Come Substract; for Moon and Sun.

Or thus,

For every 312 years Past, Add 1 day to the time of the New-Moon found as above: For 312 years to Come, Substract 1 day.

Likewise, for 131 years Past, a day is to be Added to the former account of the Suns Entrance; And for 131 years to Come, Substracted.

To find the Distance of the Sun from the Nodes of the Moon perpetually in all Lunations; Remember,

Year 17 hundred. Node, Sign 4, Degree
27, 3. 800, 43,

1. Take the Interval between the given time and 1700 Compleat, in years and dayes; allowing 12 Months to the Year, and 30 dayes to a Month: and the account will suffice for this work.

2. Multiply the years of the Interval by 43, and divide the Product by 800: the Residue multiply by 9; then take the half of this Product and distinguish the last figure from the rest by a point. So have you the degrees: and 10th parts of a degree answerable to the years of Interval:

Also, Multiply the dayes of the Interval by 43, and divide by 800: this Quotient

Quotient shews the degrees, and the remainer divided by 80, the 10th parts of a degree of the Motion for the dayes of the Interval. Then, Collect the former and latter degrees and 10ths into one sum, and reduce it into Signs, Degrees and 10ths.

3. For time afore 1700 Compleat, Add the Signs, Degrees and Tenths, thus found to 4ˢ, 27°, 3 tenths; but for time after 1700 Compleat, Substract them from 4ˢ, 27°, 3: and the Sum or Remainer shall be for the place of ☊; Adding one degree for the 10ths if they exceed 5, else rejecting them.

Alwayes in Additions, omit Cycles (to wit, 12ˢ, or 360°.) But in Substractions, add one Cycle if need be, to the Number from which you are to substract.

Next, by the Common rule for 1700, without any correction for time past or to come, find the Sign and Degree of the Suns place, and Substract the last found place of ☊ from it: The residue is the Distance of ☉ from ☊, required.

The Limits of Eclipses of the Sun and Moon, in Degrees from ☊ or ☋.

Within 16 *the Sun, and* 10 *the Moone Suffer Eclipse; Above* 18, 12, *none.*

To find the length of the Dayes and Nights in the Lat. of 52°. for ever.

To 15; 1; 1, 16; 2, 6; 3; 3; 4 *houres* ✕ 4 *and half agree.*

To the given distances of the Sun from the next Æquinoctial point, the answerable houres are these; to 15°, 1 hour; to 1 Sign, 2 houres; to 1ˢ, 12°, 3 houres; to 2ˢ, 6°, 4 houres; and to 3 Signs, 4 hours and an half: Which hours added to 12, the sum is from the Vernal Æquinox to the Autumnal the just length of the Day, but from the Autumnal to the Vernal the length of the Night in those Distances:

And

And for all other intermediate distances of ☉ from the Æquinoctial points; the Proportion is; As 15, 16 or 20°, to 60′; or as 20° to 30′; So are the degrees of the excess of the intermediate distances above 0°, 15°, 1°, 1° 16°, or 2° 6° and not exceeding 2° 26°, to the minutes of the Length of the Day or Night above 12, 13, 14, 15 or 16 houres: Always allowing 4 Degrees or Dayes afore and after the Ingress into ♋ and ♑ for Solstice.

The Length of the Day and Night taken together is 24 hours, from which if the one be substracted, there will remain the other; And,

Half the Length of the {Night / Day} is the time of {Sun Rising. / Sun Setting.}

To find the Hour of the Moons coming to South; and High-Water at London.

The Moons Age Multiply by 4; Divide
By 5 for Southing: Add 3 for the Tyde.

But when the Age of ☽ exceeds 15 dayes, you may reject 15, As in this Example.

Anno 1667 *May* the 29th. the Age of ☽ being 17 Dayes, I reject 15, and the residue 2 Multiplyed by 4 makes 8, which divided by 5, the Quotient is 1. ⅗. the hour of ☽ Southing; to which I add 3ho. and the Summe is, 4. ⅗. or 4ho. 36′. the time of Full-Sea at *London*.

To find the Interval of Dayes between any given time and 1700 *Compleat: for Computing the true places of the Sun, Moon and Planets.*

For any Year afore Christ.

To the Number of Years afore Christ Compleat (that is, less by 1 then Current) Add 1700: and Multiply this Summe of Years by 365, reserving the Product.

Divide the said Sum of Years by 4, and if there be any remainer, take the Quotient more by 1; but if 0 remaineth, take onely the Quotient.

Lastly, take the given day of the year (accounted from the beginning of *January* inclusively) from the Number of Days in the given Year; and keep the Residue: The Sum of the Product, and Quotient afore-found, with this last Residue, shall be the Interval of Dayes required.

In any Year of Christ, afore 1700 *Compleat.*

Substract the given Year of Christ Current, from 1700: work by the Residue of years as afore by the Sum; and find the Interval of dayes by the foregoing Rules.

In any Year after 1700.

☞ From the number of the Years of Christ Compleat (that is, less by 1 then the given year Current) Substract 1700.

Multiply the residue of Years by 365, and keep the Product.

Divide the said residue of Years by 4, and (not regarding the remainer) take the Quotient.

The sum of the former Product, and Quotient, together with the Day of the given Year (accounted as afore) is the Interval.

To find the true place of the Sun and Fixt-Stars, for ever.

Hundreds 17. 6, 13; 42:
28; 95: Radix thereto.
Rounds 20, less 12: 27 *Precession.*
2, 8; 3, 3: 1; 9, 8, 5, Æquation.
" 98: 5, 6, 0, 9, 9, you may
" Take to resolve the Motion of a Day.

That is,

To the Year 1700 Compleat; *December* the last Day at Noon, in the *Meridian* of *London*; The *Mean Anomaly* of ☉. 6ˢ, 13°; 42 *Centesmes*, and the *Precession* of the *Æquinox*, 28°, 95, are the *Radix*.

Also in 20 *Julian* years, the *Sun* makes Revolutions 20, less 12 *Centesmes* of a degree from his *Apogæum*: And the *Precession* of the *Æquinox* in the same 20 years, is 27 *Centesmes*.

The fixt Longitude of the *Suns Apog.* from the first ✳ of ♈, is 2ˢ, 8°; 33.

And lastly, the greatest *Æquation* of ☉, is 1°; 98: 5.

But for the more speedy resolution of the *Mean Anomaly*; take the Motion of it in a Day, *Cent.* 98: 56099.

For the Mean Anomaly of ☉, to any given time.

The Interval of dayes between the given time and 1700 Compleat, being first found by the fore-going Præcepts for that purpose.

Multiply that Interval by the given daily *Motion* of the *Mean Anomaly*, 98: 56099. or, if the Interval exceedeth not 200 years, by 98: 561.

Reduce the Product (rejecting *Cycles*) into Signes, Degrees and *Centesmes*; which, for time afore 1700 Compleat Substract from, but for time after add to the given Radix of *Mean Anomaly*, 6ˢ, 13°; 42: the residue or sum is the *Mean Anomaly* of ☉ to the proposed day at Noon; after which,

if

if there were odd houres; As 24ʰ. to 98 : 56; So are thoſe odd hours, to the *Centeſmes* of Motion to be Added to the laſt found *Mean Anomaly*; and the ſum ſhall be the *Mean Anomaly* of ☉ to the given time.

For the true Longitude of ☉ from the firſt Star of ♈.

1. To any given time, the *Mean Anomaly* of ☉ being found by the Rules afore-going; Take the *Mean Anomaly* in the firſt Quadrant, its Complement to 6 Signes in the Second, its Exceſs above 6 Signes in the third, its Complement to 12 Signes in the 4th; So have you the Mean diſtance of ☉ from the neareſt *Apog.* or *Perig.*

2. The *Mean Anomaly* being in the firſt or fourth Quadrant, as 60, to 59; but in the ſecond or third, as 59 to 60; So the Degrees of the Diſtance laſt found, to the Degrees of the Diſtance-Correct: Then,

As the *Radius*, to the Sine of the *Diſtance-Correct*; ſo the greateſt *Æquation* 1° 985, to the *Æquation* of ☉ to the given time.

The Memorial Verſe of Sines for this and the like purpoſes, you have in the End hereof.

3. If the *Mean Anomaly* were leſs then 6 Signes, Subſtract the *Æquation* from it; If more, Add the *Æquation* to it: The Reſidue or Sum is the True *Anomaly*, to which alwayes Add the *Apog.* 2ˢ. 8°. 33, and the Sum ſhall be the True Longitude of ☉ from the firſt Star of ♈.

To find the Præceſſion; with the true Longitude of ☉ from the Vernal Æquinox.

Take the Interval of years (to the neareſt half year between the given time and 1700 Compleat; Multiply thoſe years by 135, divide the Product by 100; the Quotient is the Motion of *Præceſſion* in *Centeſmes*, which reduced into Degrees, *&c.* and for time afore 1700 Compleat, Subſtracted from 28°, 95 *Cent.* but for time after added to it; the Remainer or Sum, is the *Præceſſion* of the *Æquinox* from the firſt Star of ♈ for that time.

Then to the Longitude of ☉ from the firſt Star of *Aries* found as afore, Add the *Præceſſion* of the *Æquinox*; the Sum is the true Longitude of *Sol* from the *Vernal Æquinox*.

To find the Distance of the Earth from the Sun.

Distance Earth Sun, 1000; then twice nought:
Eccentrick, 17; 3, and 2, if sought.

Take the nearest distance of the *Mean Anomaly* of ☉ from 91 or 269 degrees; and if the *Mean Anomoly* were less then 91°, or more then 269, make proportion, First as 91 to 90; but if it were more then 91° and less then 269, As 89 to 90; So the Degrees of the said distance, to the distance Correct. Secondly, As the Radius, to the Sine of the distance Correct, so is the Eccentricity 173, to the difference of Distance, which in the former case (where the proportion was as 91 to 90) Added; but in the latter case (where it was as 89 to 90) Substracted, to or from the Mean Distance 10000, gives the true Distance required; from which cut off the last figure on the right hand, and if it be 5 or more, add 1 for it to the remaining number on the left, else wholly reject it: So have you the Distance of the earth from the Sun in such parts as her Mean distance is 1000; which is to be used in finding the apparent places of ♄, ♃, ♂, ♀ and ☿.

To find the true Place of the ☽Moon for ever.

11, 7; 2. 11, 8; 1, combine.
13; 0, 6: 4, 9, 8, 7 and 9.
11: 1, 4, 0, 7, 7, Motion.
1000, 70; and 5 Æquation.
5: 2, 9, 5, 5, 7, the Nodes Recess.
1; 7, 5: 15: Latitudes Excess.

1. To the given time, find the true place of ☉ from the *Vernal Æquinox*.

2. Multiply the Interval of dayes between the given time and 1700 Compleat, by the given daily motion of the Anomaly, 13; 06: 49879. and reduce the Product into Signes, Degrees and Centesmes, and this shall be the Motion of *Mean Anomaly*.

In like manner, Multiply the same Interval by the given daily Motion of the *Apog.* 11: 14077. and Reduce the Product as afore: So have you the Motion of the *Apog.*

Then, for time afore 1700 Compleat, Substract the Motion of *Mean Anom.* from the Radix of *Mean Anomaly*, 11°, 7°; 2 *dec.* and also the Motion of the *Apog.* from the Radix of *Apog.* 11°, 8°; 1 *dec.* But for time after 1700 Compleat, Contrarily Add them both to their Radix: and the differences or summes shall be the *Mean Anomaly* and *Apog.* for the given

given day: to which, if there were odd houres, the proportional Motions of them to a day is to be Added to the *Anomaly* and *Apog.* last found; and the Summes are the *Mean Anomaly* and *Apog.* for the given time.

3. Take the neareſt diſtance of the *Mean Anomaly* of ☽ from ☉, or 6 Signes (as afore of the Sun) and ſeek the Sine thereof, Multiply it by 5, and divide the product by the Radius; the Quotient ſhews the Degrees and Cent. *&c.* of the Moons Æquation for her firſt Inequality: Then if the *Mean Anomaly* were leſs then 6 Signes, the Æquation Subſtracted from it; but if more Added to it; the Remainer or Summe is the *True Anomaly* to which Add the *Apog.* for the given time; and the Summe ſhall be the place of the *Moon* firſt Æquated; which if the *Moon* be then in ☌ or ☍ wit ☉, is her true place in her Orbite: Otherwiſe,

4. From the place of *Luna* thus found, Subſtract the true place of *Sol* from the Æquinox, the Reſidue is the Diſtance of *Luna* from *Sol*, which doubled; As the Radius to the Sine of the double diſtance (or of its exceſs above 6 or Complement to 6 or 12 Signes) So the greateſt Reflection of ☽ which is alwayes 62: 5 *Cent.* (or one 8th part of 5°) to the Reflection of ☽ at this time, which if the aforeſaid double diſtance were leſs then 6 Signes, is alwayes to be added, but if more Subſtracted.

5. To or from the *True Anomaly*, Add or Subſtract the Reflection as above, ſo have you the *Anomaly* Correct: Then, the ☽ paſſing from the ☌ or ☍ of ☉ to the □, the Complement to a quadrant of her diſtance from ☉ is to be Added; but from the □ to the ☌ or ☍, the exceſs of her diſtance above a quadrant is to be ſubſtracted to or from the *Anomaly* Correct: and the Summe or Difference is the *Synodical Anomaly*; of which if it be leſs then 6 Signes, take the half; if more, take the half of its Complement to 12 Signes.

6. For the firſt æquated diſtance of the Moon from the Earth; take the neareſt diſtance of the *Mean Anomaly* of ☽ from 93 or 267°; and if the *Mean Anomaly* were leſs then 93° or more then 267; the proportion is, As 31 to 30; but if more then 93° and leſs then 267, As 29 to 30; So the degrees of the ſaid diſtance to the diſtance Correct: Then, As the Radius, to the Sine of this diſtance Correct; So is the Eccentricity 70, to the difference of Diſtance, which in the former caſe (where the proportion was as 31 to 30) Added, but in the later caſe Subſtracted, to or from the *Mean* Diſtance 1000, gives the firſt æquated diſtance of the Moon from the Earth.

7. As the Radius 1000, to the Sine of the neareſt diſtance of ☽ from the ☌ or ☍ of ☉, ſo 44 (which is neareſt the Sine of half 5°) to the Chord of Evection, of which and the firſt æquated diſtance of the Moon from the Earth, take the *Summe* and *Difference*; Then make Proportion,

As

As the *Summe*, to the *Difference*; So the Tangent of the half *Synodical Anomaly* or Complement, to the *Tangent* of an Arch or Angle, which substracted from that half, the residue is the Evection:

But for the more convenient working by our small Canon in the End hereof, If the half Synodal Anomaly or Complement happen to be more then 80°; As the Difference to the Summe afore taken; so the Co-Tangent of the said half, to the Co-tangent of an Angle, which substracted from that half, the Residue is the Evection.

Then if the *Synodical Anomaly* were less then 6 Signes the *Evection* is to be Substracted, but if more, Added.

And if this *Evection*, and the afore-found *Reflection* are both to be Added or both Substracted, their Summe; otherwise their Difference, according to the title of the greater of them, is the Secondary *Æquation*; which Added or Substracted, to or from the place of the *Moon* first æquated, gives her true Longitude in her *Orbite* to the proposed time.

For the Place of ☊, with the true Latitude of the Moon.

1. Multiply the Interval of Dayes between the given time and 1700 Compleat by the daily motion of ☊, 5 *Cen.* 29557, and reduce the Product into Signes, Degrees and *Centesms*: Then for time afore 1700 Compleat Add, but for time after Substract those Signes, Degrees and *Centesms*, to or from the Radix of ☊, which (by our former Memorial for finding the distance of ☉ from ☊) is 4°. 27°. 3*dec.* So have you the Mean Longitude of ☊ to the given time, which in the ☌, ☍ or □ of ☉ and ☽, is also its true place, but at all other times,

As the Radius to the Sine of the Double distance of ☽ from ☉ (afore-found) So the greatest *Æquation*, of ☊, 1°; 75 *Cent.* to the *Æquation*, which if the said Double distance were less then 6 Signes, Substracted from, if more then 6 Signes, Add to the Mean Longitude of ☊, gives its true place.

2. From the true Longitude of ☽ in her Orbite, Substract the true place of ☊; the residue is the Argument of Latitude.

Then Observe that in the ☌ or ☍ of ☉ and ☽, the greatest Latitude of ☽ is 5° in the *Quartiles* 5°; 30 *Cent.* And in all intermediate distances of ☉ and ☽, If the double distance of ☽ from ☉ (afore-found) be less then 90°, take the Sine of its Complement to 90°; if between 90 and 180°, the Sine of its excess above 90°; if between 180 and 270°, the Sine of its Complement to 270°; and if more then 270°, the Sine of its excess: the Proportion is,

As

As the Radius, to that Sine; So is 15, to the *Centesmes* of the difference of the Moons greatest Latitude from 5°, 15 *Cent.* which if the double distance were more then 90° and less then 270° Added, but in the other two quadrants Substracted, to or from 5°, 15 *Cent.* gives the greatest Latitude of ☽ in that distance from ☉.

Then, As the Radius, to the Sine of the Argument of Latitude, or its neareſt diſtance from ♈ or ♎ Signes; So the greateſt Latitude laſt found, to the Latitude of ☽ required; which, if the Argument be leſs then 6 Signes, is North, but if more, South.

For the Reduction of ☽ from her Orbite to the Ecliptick.

As the Radius, to the Sine of the neareſt diſtance of the double of the Argument of Latitude from ♈ or ♎ Sgnes; So is 11 *Cent.* when the firſt æquated place of ☽ is within 1°. 12°. of the ☌ or ☍ of ☉, but at other times 12 *Cent.* to the *Centeſmes* of Reduction; which if the Argument of Latitude were leſs then 3 or between 6 and 9 Signes Subſtracted from, but between 3 and 6, or 9 and 12 Signes Added to the place of ☽ in her Orbite, gives her true place reduced to the Ecliptick.

Of ♄, ♃, ♂, ♀, *and* ☿.

Radix; *Mean-Motion for a Day*; *Æquation*; *Aphelium*, *Diſtance*; *Node*, *and Inclination*.

♄

84; 4. 3 : 3, 4, 5, 9, 5.
6; 6. *Apſis*, 7, 28; *and* 5.
9, 5, 3, 8; 5, 4, 7, *on do drive.*
2, 22; 5, *Saturn's Node.* 2; 5.

♃

Jove, 4, 8; 2. 8 : 3, 0, 9, 2, 6.
5 : 5. 5, 9; 8, *the Aphelium fix.*
5, 2, 0. 1; *and* 2, 5, 0, *ſhall be*
Diſtance. Node 2, 8. *Latitude* 1; 3.

♂

♂.

7, 8; 3. 5, 2: 4, 0, 3, 4, 7.
10; 6. 4, 1; & 2, Aphelium given.
1, 5, 2, 4. 1, 4 and 1, define
Distance of *Mars*. Node 19; 2. 1; 9.

♀.

Venus, 8, 5; 9. 1; and 60: then
2, 1, 2, 9, 2. 0; and 8 of 10.
Apsis, 9, 5, 7, 2, 3; 5 exend.
1, 15; 3. 3; 4, the work doth end.

☿.

Signes 8, 4. 4; 0, 9: 2, 3, 3, 4.
24; 1. then 7, 13; 8 more.
3, 8, 7; 80, Distance doth conclude.
15; 7. 6; 9, *Hermes* Latitude.

Anno 1700	♄	♃	♂	♀	☿
Compleat.	*s. o. dec.*	*s. o. dec.*	*s. o. dec.*	*s. o. dec.*	*s. o. dec.*
Radix Anom.	2. 24. 4	4. 8. 2	7. 8. 3	8. 5. 9	8. 4. 0
	Cen.	*Cen.*	*Cen.*	*o Cen.*	*o. Cen.*
Motion.	3: 34595	8: 30926	52: 40347	1;60:21292	4;09:2334
Æquation.	0. 6. 6	0. 5. 5	0. 10. 6	0. 0. 8	0. 24. 1
Aphelium.	7. 28. 5	5. 9. 8	4. 1. 2	9. 5. 0	7. 13. 8
Mean Dist.	9538	5201	1524	723	387
Excentri.	547	25	141	5	80
Node Ascen.	2. 22. 5	2. 8. 0	0. 19. 2	1. 15. 3	0. 15. 7
Latitude.	0. 2. 5	0. 1. 3	0. 1. 9	0. 3. 4	0. 6. 9

To find the Apparent Places of ♄ ♃ ♂ ♀ *and* ☿, *for ever.*

1. To the given time, find the Sidereal-Longitude or Place of ☉ from the first Star of ♈, with the Distance of the Earth from the Sun in such parts as her Mean Distance is 1000; and also (if you please) the Præcession of the Æquinox.

2.

2. Multiply the Interval of Dayes between the given time and 1700 Compleat by the given Daily Motion of the Planet whose place is required; Reduce the Product into Signs, Degrees and Centesmes, which for time afore 1700 Compleat Substract from, but for time after Add to the given Radix of *Mean Anomaly*; the Residue or Sum shall be the *Mean Anomaly* to the given day, to which, if there were odd houres Add their proportional Motion; So have you the *Mean Anomaly* of the Planet to the given time.

3. For the Æquation of the Planet at all times: To 90 *Cent.* Add, and from 270° Substract 3 quarters of the greatest Æquation given; the Sum is the First Limit, and the Remainer the Second Limit of the greatest Æquation. Then if the *Mean Anomaly* of the Planet be less then the first Limit, or more then the second (1) As 90°, to the Excess of the second Limit above 180°; So the Neareſt Distance of the *Anomaly* from ☉ or 12 Signes, to the Distance Correct: But contrarily if the *Mean Anomaly* be more then the First Limit, and less then the Second; As the Excess of the Second Limit above 180°, to 90°; So the Neareſt Distance of the *Anomaly* from 6', to the Distance Correct. (2) As the Radius, to the Sine of the Distance Correct; So the greatest Æquation, to the Æquation of the Planet at the given time, which if the *Mean Anom* were less then 6 Signes Substracted from it; but if more, Added to it; the Residue or Sum shall be the True *Anomaly*, to which Add the given *Aphelium*, and this Sum shall be the Heliocentrick Place of the Planet.

4. For the Distance of the Planet from ☉: To 90° Add the half of the greatest Æquation of the Planet, the Summe is the First Limit; And from 270° Substract the said half, the Residue is the Second Limit of the *Mean Distance* of the Planet from the Sun. Then take the Distance of the *Mean Anomaly* of the Planet for the given time from the Neareſt Limit: And if the *Mean Anomaly* be less then the First Limit or more then the Second make proportion (1) As the First Limit, to 90°; but if the *Mean Anomaly* be more then the First Limit, and less then the Second, As the Excess of the Second Limit above 180°, to 90°; So the Distance of the *Mean Anomaly* from the Neareſt Limit to the Distance Correct: (2) as the Radius to the Sine of the Distance Correct So is the Eccentricity of the Planet to the Difference of Distance from ☉, which if the *Mean Anomaly* were more then the Second, or less then the First Limit Added, but between the First and Second Substracted, to or from the Mean Distance, gives the True Distance of the Planet from the Sun.

5. Take the Summe and Difference of the true Distances from ☉ of the Earth and Planet whose Place is required; and next,

From the Heliocentrick place of the Planet, Substract the Sidereal Longitude of ☉, or contrarily that from this, so that less then 6 Signes may remain; the residue shall be the Commutation, of which take the half making proportion:

As the Summe to the Difference of Distances last afore-found; So the Tangent of the Half-Commutation, to the Tangent of an Arch, the Sum of which, and that half-Commutation is the Elongation of ♄, ♃ or ♂, but the Difference the Elongation of ♀ or ☿ from the Sun.

Here (for the better use of our small Table of Natural Tangents) if the Half-Commutation be more then 80°, you may thus change the Proportion;

As the Difference of Distances, to their Summe, So the Co-tangent of the Half-Commutation, to the Co-Tangent of an Arch, &c.

Then if you Substracted the Sidereal Longitude of ☉ from the Heliocentrick Place of the Planet, the Elongation Added; but if contrarily the Place of the Planet from that of ☉, Substracted; to or from the said Place of ☉, gives the Geocentrick Place of the Planet from the first Star of ♈: to which the Præcession of the Æquinox being Added, the Sum shall be the Longitude of the Planet from the Vernal Æquinox.

6. From the Heliocentrick Place of the Planet, Substract the Node, the residue is the Argument of Latitude, of which (or its neareſt distance from ☊ or 6 Signes) take the Sine, and make Proportion,

As the Radius to this Sine; so is the greatest Inclination or Heliocentrick Latitude of the Planet, to the Inclination for the given time.

And lastly, As the Sine of Commutation, to the Sine of Elongation; So the last found Inclination, to the Geocentrick Latitude of the Planet; which if the Argument be less then 6 Signes is North; if more, South.

The Calculation of the true Places of ☉, ☽, and ♂, by the Præcepts and Numbers afore-going, Anno, 1668. March the 9th day at Noon, in respect of the Equal time and Meridian of London.

For the Interval of Dayes.

1. From 1700, I Substract 1668. the residue is 32, by which I Multiply 365, and the Product is 11680.

2. I

2. I divide 32 by 4, and (without any remainer) the Quotient is 8.

3. *March* the 9th being the 69th day of the given year: From the Number of Dayes in that Year 366, I Substract 69, and the residue is 297. Then, the Product 11680, the Quotient 8, and the last found Residue 297, being Added together; the Summe is 11985, the Interval of Dayes required.

For the Mean Anomaly of ☉.

The Interval of Dayes 11985, Multiplyed by the given Daily Motion 98 *C* : 561, the Product is 1181253 *C* : 585. that is, 11812° 54 *C* : *ferè*: Then I divide 11812° by 360, and (rejecting Cycles) the Remainer is 292°, which Divided by 30, gives in the Quotient 9 Signes, and 22 Degrees remaining; also the afore-found Centesmes are 54: therefore the Motion of *Mean Anomaly* is 9°. 22°. 54 *C* : which Substracted from the given Radix 6°. 13°. 42 *C*. the Residue is, 8°. 20°. 88 *C*. the *Mean Anomaly* of ☉ required.

For the Sun's Æquation, and Sidereal Longitude.

The *Mean Anomaly* being in the third Quadrant, I take its Excess above 6 Signes 80°. 88 which is the Mean Distance from the *Apog.* then I say, As 59 to 60; So is 80°. 88, to 82°. 25. the Dist. Correct: and as *Rad.* to *Sin.* 82°.25. So the greatest Æquation 1°. 985, to the Æquation sought 1°. 97, which, because the *Mean Anomaly* is more then 6 Signes, *viz.* 8°. 20°. 88. Added to it, gives the *True Anomaly* 8°. 22°. 25. and to this Add the given *Apog.* 2°. 8°. 33. the Summe is 11°. 1°. 18. the Sidereal Longitude of ☉.

For the Præceſſion, with the true Longitude of ☉ from the Æquinox.

The Interval of Years is almoſt 33, which Multiplyed by 135 and the Product divided by 100, gives the Motion of Præceſſion 44 *C.* which Subſtracted from the Radix 28°. 95 *C.* the Reſidue is 28°. 51 *C.* the Præceſſion of the Æquinox from the Firſt Star of ♈. This Added to the Sidereal Longitude of ☉ 11ˢ. 1°. 18 *C.* the Summe is his true Longitude from the Vernal Æquinox 11ˢ. 29°. 69 *C.* that is in ♓. 29°. 69 *C.*

For the Diſtance of the Earth from the Sun.

The *Mean Anomaly* being 8ˢ. 20°. 88 *C.* that is 260°. 9 *dec. ferè* the the neareſt Diſtance between that and 269°. is 8°. 1 *dec.* I ſay (1) As 89 to 90, So 8°. 1 *dec.* to 8°. 2 *dec.* (2) As the Radius, to the Sine of 8°. 2 *dec.* So the Eccentricity 173, to the Difference of Diſtance 25 *ferè* which (according to the Rule) Subſtracted from the Mean Diſtance 10000, the Reſidue is the true Diſtance 9975 and ſomewhat more; therefore in ſuch parts as the Mean *Diſtance* is 1000, the true is 998 *ferè*.

And this much may well ſuffice for explaining all the reſt.

Anno, 1668. *March the* 9th *day* 0ho. 0′. *T. M.*

For the Place of ☉.

	ſ.	o.	C.		ſ.	o.	C.
Radix Anomaly.	6.	13.	42.	*Radix Præceſs.*	0.	28.	95.
Mot. Anom. Sub.	9.	22.	54.	*Mot. Præc. Sub.*	0.	0.	44.
Mean Anomaly.	8.	20.	88.	*Præc. Æquin.*	0.	28.	51.
Æquation Add.	0.	1.	97.				
True Anomaly.	8.	22.	85.	*Diſt. ☉ à ⊙.*			
Apog. Adde ——	2.	8.	33.	998.			
Sidereal Long.	11.	1.	18.				
Præc. Æq. Add.	0.	28.	51.				
Long. from Æq. in ♓	29.		69.				

For

For the Place of ☽.

	Anom. s.	o.	C.	Apog. s.	o.	C.	☊ s.	o.	C.
Radix ——	11.	7.	20	—— 11.	8.	10	—— 4.	27.	30
Mot. Sub.	11.	13.	88	Sub. 8.	15.	22	Add. 9.	4.	67
Anom. Med.	11.	23.	32	Apo. 2.	22.	88	☊m. 2.	1.	97
Æqu. 1. Add.		0.	58	—— ——			æq. Sub.	0.	76
Anom. Ver.	11.	23.	90	Reſt. Add. 0.	27		☊v. 2.	1.	21
Apog. Add.	2.	22.	88	An. Cor. 11.	24.	17			
☽. 1. æqu.	2.	16.	78	Com. di Ad. 12.	91.				
☉ ab æqu.	11.	29.	69	An. Synod. 7.	8				
☽ à ☉ —— ——	2.	17.	9	½ —— ——	3.	54			
Dupl. —— ——	5.	4.	18	Diſt. ☽ 1. æq. 1	☉	70			
Æqu. 2 Add.		0.	1	Chord. Ev.		43			
☽ in Orb.	2.	16.	79	Evect. Sub. 0.	26				
☊. Sub.	2.	1.	21	Æq. 2. Add. 0.	1				
Arg. Lat.	0.	15.	58	Lat. Max. 5.	29				
Red. Sub.			6						
☽ in Eclipt. ♊.		16.	73	Lat. ☽ Bor. 1.	42				

For the Place of ♂.

	s.	o.	C.
Radix Anomaly.	7.	8.	30
Motion Sub.	5.	10.	56
Mean Anomaly.	1.	27.	74
Æquat. Sub.		8.	43
True Anomaly.	1.	19.	31
Aphelium Add.	4.	1.	20
♂ Heliocent.	5.	20.	51
☉ Sidereal.	11.	1.	18
Commutation.	5.	10.	67
½ —— ——		80.	33
Elongation Sub.	4.	14.	29
♂ Geocen. Sid.	6.	16.	89
Præceſſi. Add.	0.	28.	51
♂ Geo. ab Æq. in ♏.		15.	40

Diſt. ♂ à ☉			1606
☋ à ☉			998
Diff.			608
Sum.			2604
	o.	C.	
Co-Tan.	80.	33.	170
Co-Tan.	53.	96.	728
Sum.	134.	29.	Elong. ♂
	s.	o.	dec.
Arg. Lat.	5.	1.	3
R. Sin.	28.	7. ——	480
Inc. Max. gr.		1.	9.
Inc. ♂ gr.		0.	9.
Sin. ——	19.	3. ——	331
Sin. ——	45.	7. ——	715
Incl. ♂ ——	gr.		0. 9
Lat. ♂. Bor.	gr.		1. 9

To find the Time of the true ☌ or ☍ of ☉ ☽.

First find the Day by the Common Rule of the Epact; and to the same Day at Noon Compute the true Place of the Sun from the Æquinox, and the first Æquated place of the Moon. Then if ☉ and ☽ are found exactly in ☌ or ☍, the work is done: otherwise take the difference; and if the Moon be found wanting of the ☌ or ☍, Add; if past, Substract the Motion of the Mean Anomaly of ☉ and ☽, with the *Apog.* of ☽ in a day, to or from the former; and to these Mean Motions, Compute again the true place of ☉ from the Æq. with the first Æquated place of ☽, and if ☉ and ☽ be not yet found in exact ☌ or ☍, take again the Difference: then if in the one Difference the Moon were found wanting of the ☌ or ☍ of ☉, and in the other past, the Summe of the differences; else, their difference is the daily Motion of ☽ from ☉: And,

As this daily Motion of ☽ from ☉, to the difference first found; So is 24 houres, to the Houres and Centesmes, which if ☽ were first found wanting of the ☌ or ☍ of ☉ Added, if past Substracted, to or from the Day first found, gives the Day, Hour and Cent. of the ☌ or ☍ of *Sol* and *Luna* in her Orbite, very near unto Truth.

To which time, If you once more compute the true Place of ☉ from the Æq. and of ☽ first æquated, and do find them differ any Centesmes from ☌ or ☍; As the afore-found Daily Motion of *Luna* from *Sol*, to this Difference; So 24 Hours, to the Centesmes of an Hour, which if the last found place of *Luna* were wanting of the ☌ or ☍, Added; if past, Substracted, to or from the last mentioned Day, Hour and Cent. gives the correct Æqual Time of the true ☌ or ☍ of *Sol* and *Luna* in her Orbite.

Now how to Calculate the Eclipses of the Luminaries, as also the Apparent Places of all the Planets more Exactly then by these acknowledged Short and Obvious Rules and Numbers, I have formerly shewn in my *Astronomia Carolina*: Yet may these be useful in their kind, and I doubt not but they will be as kindly acceptable unto all ingenuous Readers.

The Natural Sines to every 5 Degrees of the Quadrant and Radius 1000.

First 87. 1, 7, 4. 2, 5, 9.
3, 4, 2. 4, 2, 3. 500 Sine.
5, 7, 4. 6, 4, 3. 7 hundred 7.
7, 6, 6. 8, 1, 9. 8, 6, 6, even.
9, 0, 6. 9, 4, 0. 9, 6, 6. thus,
9, 8, 5. 9, 9, 6. then Radius.

The Summe of the Sines of any two Arches both together making 60°, is equal to the Sine of an Arch composed of 60°, and either of those two Arches: Therefore, The Sines of the first 60° being known, the rest may be easily found;

As in this Example,

For the Sine of 65°.
To the Sine of 55° —— 819
Add the Sine of 5 —— 87
The Sum is the Sine of 65° —— 906

Deg	SIN.	Co-sin	TAN.	Co-tan.	
0	0	1000	0	*Infinite*	90
1	17	1000	17	57290	89
2	35	999	35	28636	88
3	52	999	52	19081	87
4	70	998	70	14301	86
5	87	996	87	11430	85
6	105	995	105	9514	84
7	122	993	123	8144	83
8	139	990	141	7115	82
9	156	988	158	6314	81
10	174	985	176	5671	80
11	191	982	194	5145	79
12	208	978	213	4705	78
13	225	974	231	4331	77
14	242	970	249	4011	76
15	259	966	268	3732	75
16	276	961	287	3487	74
17	292	956	306	3271	73
18	309	951	325	3078	72
19	326	946	344	2904	71
20	342	940	364	2747	70
21	358	934	384	2605	69
22	375	927	404	2475	68
23	391	921	424	2356	67
24	407	914	445	2246	66
25	423	906	466	2145	65
26	438	899	488	2050	64
27	454	891	510	1963	63
28	469	883	532	1881	62
29	485	875	554	1804	61
30	500	866	577	1732	60
31	515	857	601	1664	59
32	530	848	625	1600	58
33	545	839	649	1540	57
34	559	829	675	1483	56
35	574	819	700	1428	55
36	588	809	727	1376	54
37	602	799	754	1327	53
38	616	788	781	1280	52
39	629	777	810	1235	51
40	643	766	839	1192	50
41	656	755	869	1150	49
42	669	743	900	1111	48
43	682	731	933	1072	47
44	695	719	966	1036	46
45	707	707	1000	1000	45
	co-sin	*SIN.*	*co-tan*	*TAN.*	*Deg*

FINIS.